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MATRIC NOS: 18/ENG02/095
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COURSE CODE & TITLE: MATHS 104.

1. Evaluate dy/dx at $x = 2.5$, correct to 3 s.f given
$y = (2x^2+3)/\ln 2x$

Solution
Using Quotient Rule

let $U = 2x^2 + 3$, $V = \ln 2x$
$\frac{du}{dx} = 4x$ $\quad \frac{dv}{dx} = 1/x$

$$\frac{V\,du/dx - U\,dv/dx}{V^2} = \frac{(\ln 2x)(4x) - (2x^2+3)(1/x)}{(\ln 2x)^2}$$

at $x = 2.5$

$$\frac{\ln 2(2.5)(4 \times 2.5) - (2(2.5)^2+3)(1/2.5)}{[\ln 2(2.5)]^2}$$

$$\frac{[1.609 \times 10] - [15.5 \times 0.4]}{2.590} = \frac{9.89}{2.590}$$

$= 3.818$
$\simeq 3.82$ // Answer.

2 Find the gradient of the curve $y = 2x/(x^2-5)$ at the point $(2,-4)$

3.

Solution

let $u = 2x$, $v = x^2 - 5$

$du/dx = 2$ $dv/dx = 2x$.

$$\frac{v\,du/dx - u\,dv/dx}{v^2} = \frac{(x^2-5)(2) - (2x)(2x)}{(x^2-5)^2}$$

$$y = \frac{-2x^2 - 10}{(x^2-5)^2}$$

$\therefore$ at $(2,-4)$

$$\frac{-2(2)^2 - 10}{(2^2-5)^2} = \frac{-2(4) - 10}{(4-5)^2} = \frac{-8-10}{(-1)^2}$$

$$= \frac{-18}{-1} = -18$$

$df/dx = -18$

$df/dy = 0$

$\therefore$ The gradient of the curve $= (-18, 0)$

3. If $z = 2x^3 \ln y$. Find dz/dy

Solution

$\ln = \ln(2x^3) + \ln(\ln y)$

$\frac{1}{z} \cdot \frac{dz}{dy} = \frac{1}{2x^3} \times 6x^2 + \frac{1}{\ln y} \cdot \frac{1}{y}$

$\frac{1}{z} \cdot \frac{dz}{dy} = \left[\frac{3}{x} + \frac{1}{y \ln y}\right]$

$\frac{dz}{dy} = z\left[\frac{3}{x} + \frac{1}{y \ln y}\right]$

$\frac{dz}{dy} = 2x^3 \ln y\left[\frac{3}{x} + \frac{1}{y \ln y}\right]$

$\therefore$

$\frac{dz}{dy} = 2x^3 \ln y\left[\frac{3}{x} + \frac{1}{y \ln y}\right]$ //

4 Integrate $x(2x^2+1)^{1/2}$ with respect to x from (0 to 2)

Solution

$$\int_0^2 x(2x^2+1)^{1/2}$$

let $u = 2x^2+1$

$\frac{du}{dx} = 4x$; $dx = \frac{du}{4x}$

$$\therefore \frac{1}{4}\int \sqrt{u}\, du$$

$$\int u^{1/2} = \frac{2u^{3/2}}{3}$$

$$\therefore \left[\frac{1}{4}\int \sqrt{u}\, du\right]$$

$$= \frac{u^{3/2}}{6}$$

$u = 2x^2+1$ $\therefore \frac{[2x^2+1]^{3/2}}{6}$

$$\int_0^2 x\sqrt{2x^2+1} = \int_0^2 \frac{(2x^2+1)^{3/2}}{6}$$

$$= \frac{[2(2)^2+1]^{3/2}}{6} - \frac{[2(0)^2+1]^{3/2}}{6}$$

$$= \frac{[9]^{3/2}}{6} - \frac{[1]^{3/2}}{6} = 4.33$$